Running head: Labeling and symptom reporting in IBS patients

Healing words: Using affect labeling to reduce the effects of unpleasant cues on symptom reporting in IBS patients.

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Abstract

Purpose: The present study aimed to induce elevated symptom reports through the presentation of unpleasant cues in patients with irritable bowel syndrome (IBS) and examine whether applying an emotion regulation technique (affect labeling) can reduce symptom reporting in patients.

*Methods***:** Patients diagnosed with IBS (N=29) and healthy controls (N=26) were presented with six picture series (3 pleasant, 3 unpleasant) under 3 within-subject conditions: merely viewing, emotional labeling or content (non-emotional) labeling. Each picture viewing trial was followed by affect ratings and a symptom checklist, consisting of general arousal and IBS-specific symptoms.

Results: Viewing unpleasant pictures led to overall increased symptom reports, both for arousal and gastrointestinal symptoms, in both groups. Labeling the pictures did not reduce these effects significantly, although a trend towards less arousal symptoms after unpleasant cues emerged in the patient group only, especially during emotional labeling.

Conclusions: Current findings indicate that the mere presentation of unpleasant cues can induce elevated symptom reports in IBS patients. The results of the labeling manipulation provide modest support for the effectiveness of emotion regulation strategies in reversing these effects of unpleasant cues in patients suffering from functional syndromes. Methodological issues that may have confounded present results are discussed.

Keywords: emotion regulation, affect labeling, symptom reporting, IBS patients.

Introduction

Physical symptoms not adequately explained by organic dysfunction are common in primary and secondary care [1-3]. In specialties like gastroenterology, gynecology and neurology, cases with unexplained symptomatology can exceed 50% [3,4]. Although specialty-specific functional syndromes have been proposed, these different syndromes share many features and are often considered to reflect common core mechanisms [5].

One of the most prominent shared features is their relation to emotional distress. Patients with functional syndromes show high levels of comorbid depression and anxiety disorders [6-8], while experimentally induced negative affect has been found to intensify the perception of physical symptoms more in functional syndromes patients compared to controls or patients with explained disease [9-11]. Although quite robust, this link among negative affect and medically unexplained symptoms remains poorly understood.

Among the functional syndromes, Irritable Bowel Syndrome (IBS) in particular has been linked to mechanisms related to emotional distress, like perceptual hypersensitivity to visceral sensations [12,13]. Specifically, IBS patients show larger responses of the defensive system in anticipation of visceral stimulation [14] and greater activations in brain areas related to affective processing of internal sensations (thalamus, insular and ACC sub-regions and amygdala) compared to healthy people [15]. Additionally, patients exhibit reduced activations of prefrontal areas during visceral stimulation, suggesting a deficit to down-regulate these emotional responses [15-17].

Importantly, induced state negative affect (NA) (e.g. by auditory stress) has been found to enhance the unpleasantness of visceral stimulation more strongly in IBS patients than in controls [10]. However, the role of such affective influences on the experience of symptoms has not been sufficiently explored. While IBS research has focused almost exclusively on how stress alters the

perception of actual visceral stimulation, research on non-clinical samples has shown that even slight affective manipulations by means of a picture viewing paradigm not involving experimentally induced physiological stimulation, can induce physical symptom reports especially in high habitual symptom reporters in daily life. These studies suggest that state NA can have top-down effects on symptom perception by activating symptom schemata in memory in this selected group [18,19]. However, this paradigm demonstrating the role of state NA in the top-down mechanisms involved in symptom perception has not yet been examined in patients.

In addition to its effects on the subjective experience of visceral sensations, momentary distress during visceral stimulation has been found to result in more brain activations in insula, ACC and VLPFC and less activation in DLPFC for IBS patients compared to controls [20]. This suggests that under stressful conditions, IBS patients fail to recruit inhibitory mechanisms to regulate pain. These findings, along with studies showing deficient emotion regulation in other functional syndromes [21] and theoretical views connecting chronic pain with reduced self-regulation [22], propose a reduced ability for self- and emotion regulation as an important mechanism influencing the relation between NA and unexplained symptoms. They further advocate the possible benefits of interventions targeting inhibitory control over emotional reactions in reducing symptomatology in functional syndrome patients.

One way to activate inhibitory processes is the utilization of emotion regulation techniques to down-regulate affective reactions. Such techniques have been linked with increased activations in prefrontal and cingulate areas and parallel reductions in amygdala activation [23,24]. Similar effects on brain activity and self-reported affect have been reported for implicit emotion regulation strategies, like affect labeling [25-27]. Merely assigning emotional labels to unpleasant stimuli has been found to reduce negative affect in both non-clinical and patient samples [27,28]. Although it is not yet clear which aspect of affect labeling produces such regulatory effects, it is assumed that labeling an emotion initiates a more cognitive or semantic processing of the emotion which entails

the activation of prior conceptual knowledge about emotions [29]. This process seems to disrupt or inhibit the more automatic components of emotion response, thus resulting in incidental down-regulation of emotion [30].

Patients with functional syndromes, who are less successful in intentionally employing emotion regulation strategies [21], could possibly benefit by an implicit strategy like affect labeling. Supporting evidence comes from a study using a non-clinical sample, which showed that labeling compared to merely viewing unpleasant pictures reduced momentary symptom reports, especially in people reporting frequent unexplained symptoms in daily life [31]. However, it is not known whether such a brief intervention would have a similar effect in patients.

Present study

The present study aimed to examine a) whether the mere presentation of unpleasant pictures induces elevated symptom reports in patients with IBS, and b) whether an implicit emotion regulation strategy, namely affective labeling, can inhibit these effects on symptom reports. To this end, a picture viewing paradigm previously used to induce elevated symptom reports [18, 19] was combined with an affect labeling task [31] and administered to IBS patients and healthy controls. Specifically, participants viewed pleasant and unpleasant pictures under three within-subject conditions: a) merely viewing the pictures, b) choosing a non-emotional label for the pictures (content labeling) and c) choosing an emotional label for the pictures (emotion labeling). Each picture viewing condition was followed by a symptom checklist.

We expected that a) IBS patients would report more symptoms than controls, especially gastrointestinal ones, in all conditions, b) unpleasant pictures would result in increased symptom reports, especially in the patient group, and c) the two labeling conditions would reduce symptom reports compared to merely viewing unpleasant pictures as previously found [31], but this effect was expected to be more pronounced in the patient group.

Methods

Participants

The sample consisted of IBS patients (N=29, 7 males, M_{age}=37.55, SD_{age}=12.46, range=18-54) recruited from the general gastroenterology and neurogastroenterology outpatient clinics of the University Hospital Gasthuisberg, Leuven. The IBS diagnosis was made by gastroenterologists based on the Rome III criteria for IBS [32] and after the exclusion of organic dysfunctions as potential sources for patients' symptoms. A healthy control group (N=26, 4 males, M_{age}=36.50, SD_{age}=12.65, range=19-55) was recruited via local advertisements. The groups did not differ in age or gender proportions.

Exclusion criteria for the control group were any self-reported current disease or chronic medical or mental disorder or medication intake (except for oral contraceptives or occasional anti-allergic medication). For the patient group, mental disorders and medication use were not an exclusion criterion; 21 patients were taking medication (antireflux, antispasmodic, anti-inflammation, analgesics), 2 patients reported minor physical problems, 4 patients other functional syndromes and 3 psychological problems. Participants were also excluded post-hoc if they did not experience the expected changes in pleasantness during the task, that is pleasantness ratings lower than average (< 5 on a 1-9 scale) for at least one of the negative trials and higher than neutral for at least one of the positive trials (3 patients, 1 control). Participants received monetary reimbursement for their participation. The study was approved by the Medical Ethical Committee of UZ Gasthuisberg.

Tasks

Modified Affect Labeling task. A modified Affect Labeling task, consisting of six picture viewing trials (3 pleasant/3 unpleasant), previously applied on a student sample [31], was used. Pictures

were selected from the International Affective Picture System (IAPS; [33])[1] based on ratings provided by students in other studies by our group, and grouped into six sets of 10 pictures, so that sets of similar pleasantness did not differ on pleasantness or arousal ratings[2]. Based on norms by Mikels et al. [34], each pleasant set included five pictures depicting excitement (e.g. skiing) and five depicting contentment (e.g. cute babies) and each unpleasant set included five pictures depicting sadness (e.g. cemetery) and five fear (e.g. gun).

During each trial, 10 IAPS pictures were presented in the upper part of the screen for 6 sec each (no inter-stimulus interval) under 3 within-subject conditions: a) VIEW: merely watch the pictures, b) LABEL EMOTION: select from two emotion words presented below the picture (two out of: *excited, content, sad, afraid*) the one most applicable to the depicted emotion and c) LABEL CONTENT: select from two words presented below the picture (two out of: *object, animal, human, landscape*) the one most applicable to the content of the picture.

Each trial started with a word cue stating which task participants had to perform, while at the end of each picture set, participants completed affect ratings and a symptom checklist.

Measures

Affect ratings. After each picture viewing trial participants rated their affect using a computerized 9-point version of the Self-Assessment Manikin (SAM; [35]). Three sets of 9 human figures depicting gradually increasing pleasantness, arousal and control were presented and participants selected the figures that represented their level of pleasantness, arousal and control during the trial.

[1] Positive1: 1463, 1920, 2550, 4574, 5201, 5260, 7330, 8030, 8080, 8185; Positive 2: 1620, 2341, 5700, 5760, 5849, 7280, 8200, 8370, 8461, 8490; Positive 3: 1710, 2311, 2360, 5891, 7260, 8033, 8190, 8300, 8470, 8502; Negative1: 1114, 2095, 2520, 2692, 2900.1, 5971, 6315, 6821, 9181, 9611; Negative2: 1525, 6190, 6242, 9001, 9410, 9425, 9426, 9520, 9561, 9911; Negative3: 1932, 2800, 5972, 6300, 6370, 6800, 6838, 9041, 9140, 9421.

[2] Positive pleasantness ratings (1-9): M1= 7.50 SD1= 0.36, M2= 7.57 SD2=0.46, M3=7.55 SD3=0.60; Positive arousal ratings (1-9): M1= 5.39 SD1= 1.30, M2= 5.09 SD2=1.27, M3= 5.14 SD3=1.09; Negative pleasantness ratings (1-9): M1= 2.72 SD1= 0.79, M2= 2.58 SD2=0.65, M3=2.72 SD3=0.71; Negative arousal ratings (1-9): M1= 5.80 SD1= 0.77, M2= 5.71 SD2=1.02, M3= 5.77 SD3=0.75.

Symptom checklist. A 14-item list of physical symptoms was also completed after each trial. The checklist included a variety of symptoms (*chest tightness, pounding of the heart, headache, fatigue, not able to breathe deeply, rapid heartbeat, dizziness, muscular pain, burning sensation in the eyes*), previously used in a similar picture viewing paradigm [18], while gastrointestinal symptoms *(abdominal or stomach cramps, regurgitations, nausea, abdominal pain, abdominal bloating*) were added to examine the hypotheses of this study. Participants rated the presence of each symptom on a 5-point Likert scale (*1=not at all, 5=very strong*). Total scores (range: 14-70) were calculated and used in analyses.

Besides total scores, analyses were also conducted for subsets of symptoms. Subsets were determined via principal component analysis of the symptom checklist, using data from a student sample (N=61, 7 males, M_{age}=18.90, SD_{age}=1.25). The principal component analysis resulted in two subsets of symptoms[3]: a) four symptoms related to cardio-respiratory indicators of physiological arousal (*chest tightness, pounding of the heart, not able to breathe deeply* and *rapid heartbeat;* factor eigenvalue=3.15, Cronbach's α=.75, total variance explained=22.47%) and b) four pain-related/gastrointestinal (GI) symptoms (*headache, muscular pain, stomach/abdominal cramps* and *stomach pain;* factor eigenvalue=2.16, Cronbach's α=.70, total variance explained=15.45%). This structure was largely confirmed in the IBS patient group (N=29), although for the patients the second factor also included the item *bloated stomach*. Despite its small size, the patient group is considered more representative of the population of interest, thus the subsets computed for the analyses were: one with four arousal-related items and one with five pain/GI-related items as suggested by the patient sample.

Group characteristics

[3]A parallel analysis procedure [36] was first conducted to determine the number of reliable factors, which suggested a two-factor structure for the checklist. A principal component analysis (PCA) with varimax rotation and factor extraction constrained to two factors (KMO = .57; $\chi 2$ (91) = 242.61, p<.001) confirmed the two-factor structure, which could explain 37.91% of the variance. Items loading .60 or higher were retained for each of the two factors.

Habitual symptom reporting. The Checklist for Symptoms in Daily Life based on the checklist of Wientjes & Grossman [37] was administered to assess participants' level of habitual symptom reporting. Participants reported how often they experienced 39 everyday symptoms from various modalities (e.g. headache, back pain) over the past year on a 5-point Likert Scale (*1=never, 5=very often*). Total scores (ranging from 39 to 195) were calculated.

Anxiety and depression. The Dutch version [38] of the Hospital Anxiety and Depression Scale (HADS; [39]) was used to assess participants' level of anxiety and/or depression. The HADS consists of 14 questions, assessing anxiety and depressive feelings/symptoms over the past week on a 4-point Likert scale. Separate scores for anxiety and depression were calculated.

Procedure

Testing took place at the gastrointestinal unit of UZ Gasthuisberg during the outpatient consultations. Patients diagnosed with IBS were invited by their doctors to participate in a study "examining the effects of emotions on IBS", whereas controls were invited to the clinic via email. Upon arrival to the testing room, participants gave written informed consent and completed a brief inventory assessing health status and demographic information and the Checklist for Symptoms in Daily Life.

Next, participants were introduced to the three tasks of the modified Affect Labeling task. For the VIEW task, participants were instructed to merely view the pictures and allow natural responses to the pictures, while for LABEL EMOTION and LABEL CONTENT tasks they were asked to choose among two given labels the one most relevant to the picture.

When participants had no further questions, the experimenter left the room and participants completed the six picture viewing trials. Each trial consisted of: a) a 3-sec presentation of a word cue signaling the task participants had to do (VIEW, LABEL EMOTION, LABEL CONTENT), b)

a 60-sec picture viewing period, and c) a 1.5 min inter-trial period, during which participants completed electronic affect ratings and the symptom checklist.

The trials were semi-counterbalanced with 12 orders created in such a way that each of the 6 trials was presented twice at a certain order position, while each pleasant/unpleasant picture set was presented four times for each task (view, label emotion, label content). Affect 4.0. [40] was used for programming the experiment, while testing was done on a 13-inch laptop computer.

At the end of the experiment, participants received a set of questionnaires (including the HADS), which they had to complete at home and send back.

Design and data analyses

A Group (controls, patients) x Task (view, label content, label emotion) x Affective cue (positive, negative) repeated measures ANOVA design was used. Analyses were conducted on a) the affect ratings (pleasantness, arousal, control) as a manipulation check, b) the total symptom score, and c) the scores for arousal- and pain/GI-related symptom subsets. Significant interactions, and those related to a priori hypotheses were followed up with separate simple effect ANOVAs. For the manipulation checks, a significant main effect of Affective cue would denote successful manipulation of affect, while an Affective cue x Task interaction would denote the expected modulation of affect by labeling tasks. As for the main analyses, in order to examine our first hypothesis, i.e. whether unpleasant pictures induced changes in symptom reports differentially in patients and controls without any intervention, we examined the Affective cue x Group interaction for the View condition only with the α criterion adjusted to .016 (Bonferroni adjustment). To examine our second hypothesis, i.e. whether the two labeling tasks moderate the effects of unpleasant pictures differentially for patients and controls, the Affective cue x Task interaction was examined separately for each group, regardless of the higher order 3-way interaction (α adjusted to .025). Greenhouse-Geisser corrected p-values and epsilon are reported when the

sphericity assumption was violated. Analyses were conducted with STATISTICA 11.0 (Statsoft, Inc., Tulsa, OK). The principal component analysis procedures were run with SPSS 17.0.

Results

Descriptive statistics

Table 1 presents means and SDs for each group on various characteristics. The groups differed as expected on habitual symptom reporting, anxiety and depression (Table 1). Within the patient group, 18 people were on medication to manage their IBS symptoms, one person was taking antidepressants, and one anxiolytics. One patient was receiving psychological treatment for IBS and two for non-IBS related reasons.

Manipulation checks

Analyses showed that picture viewing elicited the expected changes in perceived pleasantness, arousal and control in both groups, thus confirming the intended manipulation. Specifically main effects of Affective cue were observed for each measure with positive trials (with pleasant pictures) resulting in higher pleasantness ($F(1,53) = 389.18$, $p < .0001$, partial $\eta^2 = .88$), lower arousal ($F(1,53) = 50.53$, $p < .001$, partial $\eta^2 = .49$) and higher perceived control ($F(1,52) = 43.58$, $p < .001$, partial $\eta^2 = .46$) compared to negative trials (with unpleasant pictures; see means in Table 2).

Furthermore, the two labeling conditions tended to dampen these affective reactions, although the effect was mainly observed for pleasantness ratings. Specifically, a significant Affective cue x Task interaction was found for perceived pleasantness ($F(2,106) = 18.16$, $p < .001$, partial $\eta^2 = .26$). Follow-up analyses showed that the two labeling conditions resulted in lower pleasantness compared to the view condition for positive trials, $F(2,106) = 17.02$, $p < .001$, partial $\eta^2 = .24$, and content labeling resulted in less unpleasantness compared to the view condition for

negative trials, $F(2,106) = 4.28$, $p < .05$, partial $\eta^2 = .07$ (Figure 1a). This interaction was highly significant for both groups ($p < .0001$). As for arousal and control ratings, the effects of Affective cue were not significantly moderated by Task (Figures 1b & 1c).

Main analyses – Hypotheses testing

Group effect. IBS patients reported overall more symptoms in total and more pain/GI symptoms than controls ($F(1,52) = 6.04$, $p < .05$, partial $\eta^2 = .10$ and $F(1,52) = 8.12$, $p < .01$, partial $\eta^2 = .14$ respectively). A main effect of Group was not observed for arousal symptoms.

Affective cue effect. As expected, overall more symptoms were reported after negative than positive trials for the total symptom score, $F(1,52) = 23.81$, $p < .001$, partial $\eta^2 = .31$, as well as the arousal and pain/GI subsets ($F(1,52) = 25.47$, $p < .001$, partial $\eta^2 = .33$ and $F(1,52) = 6.49$, $p < .05$, partial $\eta^2 = .11$ respectively). The Affective cue effect was not moderated by Group during the View condition for the total symptom score nor for pain/GI symptoms, although a nonsignificant trend emerged towards higher arousal symptom reports in IBS patients than controls after merely viewing negative compared to positive pictures, $F(1,53) = 2.40$, $p = .11$, partial $\eta^2 = .05$.

Labeling effects. For the total symptom scores, no Task effect or Affective cue x Task interaction was found for either group. Similarly, no Task effects were found for the pain/GI subset. However, for the arousal symptoms, a trend for an Affective cue x Task x Group interaction was observed, $F(2,104) = 2.72$, $\varepsilon = .74$, $p = .09$, partial $\eta^2 = .05$. Separate analyses per group showed a trend towards an Affective cue x Task interaction for IBS patients ($F(2,56) = 2.96$, $\varepsilon = .74$, $p = .08$, partial $\eta^2 = .10$). Follow-up analyses (paired-sample t-tests for each task) showed that for IBS patients the negative trials led to significantly more arousal symptoms than positive ones only during the View condition ($t(28) = 4.03$, $p < .001$), while the difference between positive and negative trials tended to reduce at the two labeling conditions (emotion labeling: $t(28) = 1.28$, p

=.21, content labeling: t(28)=2.13, p=.04, Bonferroni adj.: p<.025). This trend was not observed in controls (Figure 2).

Discussion

Previous literature suggests that unpleasant cues augment symptom reporting, a bias that, according to data from a non-clinical sample, is reduced when people regulate their negative affect by verbally labeling these cues [31]. The present study aimed to extend prior findings by examining whether unpleasant cues increase momentary symptom reports in IBS patients and whether this can be reversed by applying an implicit emotion regulation strategy. To this end, patients diagnosed with IBS and healthy controls completed a modified Affect Labeling task, which included viewing pleasant and unpleasant pictures under a merely viewing condition, an emotion labeling or a non-emotional labeling condition, followed by a symptom checklist.

Affect ratings after each trial confirmed that the pictures induced the expected affective reactions. Main analyses further showed that this affective manipulation modulated momentary symptom reports as unpleasant pictures led to overall elevated symptoms reports. Although the increase was rather small, this effect is in line with findings from studies with student populations [18,19], and it indicates that mild unpleasant stimulation can influence the reporting of physical symptoms in both non-clinical and patient samples. The current manipulation differs importantly from paradigms typically used in IBS research, as it does not use experimentally-induced physiological stimulation, e.g. by means of rectal distensions [10]. Rather, it assesses affective influences on self-reported symptoms with little actual physiological input and as such is highly relevant for patient groups experiencing symptoms unrelated to detectable physiological dysfunction. The fact that such a paradigm induced elevated symptom reporting in IBS patients adds to prior findings emphasizing the role of top-down schematic influences in the experience of symptoms in this group [41].

Nevertheless, the effect of unpleasant cues on symptom reports was not more pronounced in IBS patients, as initially hypothesized. Only for arousal symptoms, there was a tendency for unpleasant cues to result in more symptom reporting for IBS patients compared to controls. This lack of strong group differences on the effects of affective cues contradicts findings from non-clinical samples showing more pronounced effects of unpleasant pictures for high habitual symptom reporters scoring high for trait NA [18,19], as well as research showing more profound effects of induced NA in the perception of visceral sensations in IBS patients [10,20]. A possible explanation for this discrepancy may be the rather mild affective manipulation used in our study. Most studies with patients have used rather intense emotion or stress inducing stimuli (auditory stress), which may suggest that patients are less susceptible to mild contextual cues. This implies that a more intense manipulation of state NA is needed for its differential effects on symptom reporting in a patient group compared to healthy controls to emerge.

A second aim of this study was to examine whether affect labeling can reduce the effects of unpleasant pictures on symptom reporting. Manipulation checks indicated that the two labeling conditions dampened the affective reactions to the pictures, confirming the emotion regulatory function of both emotional and non-emotional labeling. However, labeling effects on affect ratings were not as pronounced as previously found [31]. This may be due to the fact that unpleasant pictures in this sample did not elicit very strong affective reactions. As a result, there may have not been enough room for robust labeling effects to emerge. As for the effects of labeling on symptom reports, current results provide only weak support for the hypothesis that labeling reduces symptom reporting during negative trials. The expected interaction between Task and Affective cue was not found for total symptom scores, while, when subsets of symptoms were explored, a tendency towards the expected pattern of data was observed only for the arousal-related symptoms. Specifically, both labeling conditions tended to reduce affective influences on arousal symptoms, as hypothesized, but only for IBS patients. The fact that this effect was more profound

in patients is in line with our hypothesis that patients, who are probably less able to spontaneously regulate emotional reactions in an effective way [21,42,43], can benefit more from emotion regulatory procedures. Even though the effect was rather small, it provides initial experimental data that can complement findings from clinical studies showing that emotion regulation techniques focused on the verbalization of affect, like expressive writing [44], and attentional control, like mindfulness [45-47], can reduce stress and symptom reports in IBS patients.

However, it is important to note that affect labeling in our study did not influence pain/GI symptom reports. Thus, assigning labels to unpleasant stimuli attenuated slightly the experience of symptoms related to emotional arousal, but not of symptoms that characterize the condition of IBS patients. This may again be due to the mild affective manipulation and the subsequent limited labeling effects. Stronger manipulations may be required for situational influences to be observed on symptoms that are relevant and so pervasive into the lives of IBS patients.

Besides the lack of a strong affective manipulation, other limitations should be noted. The reported symptoms during the experiment were rather low (at the lower end of the symptom scale), which is expected as the paradigm did not include the induction of physiological stimulation. However, this resulted in small changes on symptom reporting between conditions, which possibly reduced the strength of current findings. Furthermore, current findings were based solely on self-reports, which can be influenced by participant expectations and demand characteristics. Recording physiological indices of emotional reactivity (e.g. heart rate, skin conductance) during picture viewing could confirm the intended affective manipulations and eliminate the possibility of mere reporting bias. Another issue is that the two groups differed in various parameters of socio-economic status as well as in medication use (many IBS patients were using medication to control their symptoms), factors that could have confounded the results. Finally, the limited number of males in the sample did not allow for examining gender differences in the task, even though gender differences in symptom reporting in general have been systematically reported [48].

Further research using emotional stimuli that elicit stronger emotional reactions, like film clips or imagery, could delineate the trends seen in our study. Furthermore, IBS patients have more localized and specified symptoms, compared to other functional groups. Such specificity may be linked to less negative affect, as has been shown in the context of anxiety disorders [49]. Thus, future research should also examine the effectiveness of emotion regulation strategies in other groups of functional syndrome patients with more widespread symptomatology and possibly more overall emotional distress, like CFS or fibromyalgia.

In conclusion, the present study replicated the augmenting effects of unpleasant cues on symptom reporting in a functional syndrome patient sample and provides initial indications that emotion regulatory processes, like labeling emotional cues, can reduce to some extent the affective biases on symptom perception, especially for functional syndrome patients. Further research is needed to explore the therapeutic role of such emotion regulation strategies in functional syndromes.

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Compliance with Ethical Standards

Each of the following authors, Elena Constantinou, Katleen Bogaerts, Lukas Van Oudenhove, Jan Tack, Ilse Van Diest and Omer Van den Bergh, declares that s/he has no conflict of interest, that all procedures performed in this study were in accordance with the ethical standards of both the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards, and that informed consent was obtained from all individual participants included in the study.

References

[1] Steinbrecher N, Koerber S, Frieser D, Hiller W. The prevalence of medically unexplained symptoms in primary care. Psychosomatics. 2011;52(3):263-71.

[2] Kroenke K. Patients presenting with somatic complaints: epidemiology, psychiatric co-morbidity and management. Int J Meth Psych Res. 2003;12(1):34-43.

[3] Nimnuan C, Hotopf M, Wessely S. Medically unexplained symptoms: an epidemiological study in seven specialities. J Psychosom Res. 2001; 51:361-7.

[4] Reid S, Wessely S, Crayford T, Hotopf M. Medically unexplained symptoms in frequent attenders of secondary health care: retrospective cohort study. Brit Med J. 2001; 322:1-4.

[5] Wessely S, Nimnuan C, Sharpe M. Functional somatic syndromes: one or many? Lancet. 1999; 354:936-9.

[6] Henningsen P, Zimmermann T, Sattel H. Medically unexplained physical symptoms, anxiety, and depression: a meta-analytic review. Psychosom Med. 2003;65:528-33.

[7] Löwe B, Spitzer RL, Williams JB, Mussell M, Schellberg D, Kroenke K. Depression, anxiety and somatization in primary care: syndrome overlap and functional impairment. Gen Hosp Psychiat. 2008;30(3):191-9.

[8] De Waal MW, Arnold IA, Eekhof JA, Van Hemert AM. Somatoform disorders in general practice prevalence, functional impairment and comorbidity with anxiety and depressive disorders. Brit J Psychiat. 2004;184(6):470-6.

[9] Montoya P, Sitges C, García-Herrera M, Izquierdo R, Truyols M, Blay N, et al. Abnormal affective modulation of somatosensory brain processing among patients with fibromyalgia. Psychosom Med. 2005;67:957-63.

[10] Dickhaus B, Mayer EA, Firooz N, Stains J, Conde F, Olivas TI, et al. Irritable bowel syndrome patients show enhanced modulation of visceral perception by auditory stress.

Am J Gastroenterol. 2003;98:135–43.

[11] Murray CD, Flynn J, Ratcliffe L, Jacyna MR, Kamm MA, Emmanuel AV. Effect of acute physical and psychological stress on gut autonomic innervation in irritable bowel syndrome. Gastroenterology. 2004;127(6):1695-1703.

[12] Kennedy P J, Clarke G, Quigley EM, Groeger JA, Dinan TG, Cryan JF. Gut memories: towards a cognitive neurobiology of irritable bowel syndrome. Neurosci Biobehav R. 2012;36(1):310-40.

[13] Mayer EA, Naliboff BD, Chang L, Coutinho SV. V. Stress and irritable bowel syndrome. Am J Physiol-Gastr L. 2001;280(4):519-24.

[14] Naliboff BD, Waters AM, Labus JS, Kilpatrick L, Craske MG et al. Increased acoustic startle responses in IBS patients during abdominal and nonabdominal threat. Psychosom Med. 2008;70(8): 920-7.

[15] Tillisch K, Mayer EA, Labus JS. Quantitative meta-analysis identifies brain regions activated during rectal distension in irritable bowel syndrome. Gastroenterology. 2011;140(1):91-100.

[16] Berman SM, Naliboff BD, Suyenobu B, Labus JS, Stains J, Ohning G et al. Reduced brainstem inhibition during anticipated pelvic visceral pain correlates with enhanced brain response to the visceral stimulus in women with irritable bowel syndrome. J Neurosci. 2008;28(2):349-59

[17] Mayer EA, Berman S, Suyenobu B, Labus J, Mandelkern MA, Naliboff BD et al. Differences in brain responses to visceral pain between patients with irritable bowel syndrome and ulcerative colitis. Pain. 2005;115: 398-409.

[18] Bogaerts K, Janssens T, de Peuter S, Van Diest I, Van den Bergh O. Negative affective pictures can elicit physical symptoms in high habitual symptom reporters. Psychol Health. 2010;25(6): 685-98.

[19] Constantinou E, Bogaerts K, Van Diest I, Van den Bergh O. Inducing Symptoms in High Symptom Reporters via Emotional Pictures: The Interactive Effects of Valence and Arousal. J Psychosom Res. 2013;74(3): 191-6.

[20] Elsenbruch S, Rosenberger C, Bingel U, Forsting M, Schedlowski M, Gizewski ER. Patients with irritable bowel syndrome have altered emotional modulation of neural responses to visceral stimuli. Gastroenterology. 2010;139(4): 1310-9.

[21] van Middendorp H, Lumley MA, Jacobs JWG, van Doornen LJP, Bijlsma JWJ, Geenen R. Emotions and emotional approach and avoidance strategies in fibromyalgia, J Psychosom Res 2008;64:159–67

[22] Solberg Nes L, Roach AR, Segerstrom SC. Executive functions, self-regulation, and chronic pain: a review. Ann Behav Med. 2009;37(2):173-83.

[23] Berkman ET, Lieberman MD. Using neuroscience to broaden emotion regulation: Theoretical and methodological considerations. Soc Personal Psychol Compass. 2009;3:475-93.

[24] Ochsner KN, Ray RD, Cooper JC, Robertson ER, Chopra S, Gabrieli JDE, Gross JJ. For better or for worse: neural systems supporting the cognitive down- and up-regulation of negative emotion. NeuroImage. 2004;23:483-99.

[25] Hariri AR, Bookheimer SY, Mazziotta JC. Modulating emotional responses: effects of a neocortical network on the limbic system. Neuroreport. 2000;11(1):43–8.

[26] Lieberman MD, Eisenberger NI, Crockett MJ, Tom SM, Pfeifer JH, Way BM. Putting Feelings Into Words: Affect Labeling Disrupts Amygdala Activity in Response to Affective Stimuli. Psychol Sci. 2007;18(5):421-8.

[27] Lieberman MD, Inagaki TK, Tabibnia G, Crockett MJ. Subjective responses to emotional stimuli during labeling, reappraisal, and distraction. Emotion. 2011;11(3):468-80.

[28] Kircanski K, Lieberman MD, Craske MG. Feelings Into Words: Contributions of Language To Exposure Therapy. Psychol Sci. 2012;23(10): 1086-91.

[29] Barrett LF. Solving the emotion paradox: Categorization and the experience of emotion. Pers Soc Psychol Rev. 2006;10(1): 20-46.

[30] Lieberman MD. Why symbolic processing of affect can disrupt negative affect: Social cognitive and affective neuroscience investigations. In: Todorov A, Fiske S, Prentice D, editors. Social neuroscience: Toward understanding the underpinnings of the social mind. New York, NY: Oxford University Press; 2011. pp. 188–209.

[31] Constantinou E, Van den Houte M, Bogaerts K, Van Diest I, Van den Bergh O. Can words heal? Using affect labeling to reduce the effects of unpleasant cues on symptom reporting. Front Psychol. 2014; 5:807. doi: 10.3389/fpsyg.2014.00807 .

[32] Thompson WG, Longstreth GF, Drossman DA, Heaton KW, Irvine EJ, Müller-Lissner SA. Functional bowel disorders and functional abdominal pain. Gut. 1999;45(suppl 2):II43-7.

[33] Lang PJ, Bradley MM, Cuthbert B. International Affective Picture System (IAPS): lnstruction Manual and Affective Ratings. Technical Report A-6. University of Florida, Gainesville (FL); 2005.

[34] Mikels JA, Fredrickson BL, Larkin GR, Lindberg CM, Maglio SJ, Reuter-Lorenz PA. Emotional category data on images from the International Affective Picture System. Behav Res Methods. 2005;37:626-30.

[35] Bradley MM, Lang PJ. Measuring emotion: The self-assessment manikin and the semantic differential. J Behav Ther Exp Psychiatry. 1994;25:49-59.

[36] Horn JL. A rationale and test for the number of factors in factor analysis. Psychometrika. 1965;30(2): 179-85.

[37] Wientjes CJ, Grossman P. Over-reactivity of the psyche or the soma? Interindividual

associations between psychosomatic symptoms, anxiety, heart rate, and end-tidal partial carbon dioxide pressure. Psychosom Med. 1994;56:533-40.

[38] Spinhoven PH, Ormel J, Sloekers PPA, Kempen GIJM, Speckens AEM, Hemert AV. A validation study of the Hospital Anxiety and Depression Scale (HADS) in different groups of Dutch subjects. Psychol Med. 1997;27(2):363-70.

[39] Zigmond AS, Snaith RP. The hospital anxiety and depression scale. Acta Psychiat Scand. 1983; 67(6):361-70.

[40] Spruyt A, Clarysse J, Vansteenwegen D, Baeyens F, Hermans D. Affect 4.0: A free software package for implementing psychological and psychophysiological experiments. Exp Psychol 2010;57:36-45.

[41] Crane C, Martin M. Illness schema and level of reported gastrointestinal symptoms in irritable bowel syndrome. Cognitive Ther Res. 2003;27(2):185-203.

[42] Keefe FJ, Lumley M, Anderson T, Lynch T, Carson KL. Pain and emotion: new research directions. J Clin Psychol. 2001;57(4):587-607.

[43] Porcelli P, Taylor GJ, Bagby RM, De Carne M. Alexithymia and functional gastrointestinal disorders. Psychother Psychosom. 1999;68(5):263-9.

[44] Halpert A, Rybin D, Doros G. Expressive writing is a promising therapeutic modality for the management of IBS: A pilot study. Am J Gastroenterol. 2010;105:2440-8.

[45] Gaylord SA, Palsson OS, Garland EL, Faurot KR, Coble RS, Mann JD, et al. Mindfulness training reduces the severity of irritable bowel syndrome in women: results of a randomized controlled trial. Am J Gastroenterol. 2011;106(9):1678-1688.

[46] Ljótsson B, Falk L, Vesterlund AW, Hedman E, Lindfors P, Rück C, et al. Internet-delivered exposure and mindfulness based therapy for irritable bowel syndrome–a randomized controlled trial. Behav Res Ther. 2010;48(6):531-539.

[47] Zernicke KA, Campbell TS, Blustein PK, Fung TS, Johnson JA, Bacon SL, Carlson LE.

Mindfulness-based stress reduction for the treatment of irritable bowel syndrome symptoms: a randomized wait-list controlled trial. Int J Behav Med, 2013;20(3):385-396.

[48] Barsky AJ, Peekna HM, Borus JF. Somatic symptom reporting in women and men. J Gen Intern Med. 2001;16(4):266-75.

[49] McTeague LM, Lang PJ. The anxiety spectrum and the reflex physiology of defense: from circumscribed fear to broad distress. Depress Anxiety. 2012;29(4) :264-81.

Table 1. Group differences in self-reported variables

Measure	Group - Mean (SD)		t(df)
	Controls	Patients	
Age	36.50 (12.65)	37.55 (12.46)	-0.31 (53)
BMI	23.06 (3.41)	23.10 (4.09)	-0.04 (53)
CSD	61.81 (10.73)	83.83 (15.81)	-5.97 (53)***
HADS-anxiety	4.19 (2.56)	8.21 (3.68)	-4.51 (48)***
HADS-depression	4.15 (1.40)	7.04 (3.24)	-4.15 (48)***
HADS-total	8.35(3.78)	15.25 (6.36)	-4.71 (48)***

Note: ***p<.001

BMI = Body Mass Index, CSD = Checklist for Symptoms in Daily Life, HADS = Hospital Anxiety and Depression Scale